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# Proceedings

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# **RISK PERCEPTION AND SAFETY BEHAVIOUR: AN ETHNOGRAPHIC STUDY**

**David Oswald<sup>1</sup>, Fred Sherratt<sup>2</sup> & Simon Smith<sup>1</sup>**

<sup>1</sup> *University of Edinburgh, King's Buildings, West Mains Road, Edinburgh, EH9 3JN, UK*

<sup>2</sup> *Anglia Ruskin University, Bishop Hall Lane, Chelmsford, CM1 1SQ*

In the construction industry, poor risk perception has been suggested to being highly influential factor in unsafe behaviours. To explore the influence of risk perception on unsafe acts in construction, an ethnographic approach was undertaken on a major project (+£500m) in the UK. The aim of the study was to identify the importance of risk perception and the factors that influence it. Literature has found two key factors which influence risk perception ratings. These factors are if the risk is unknown (unknown risks are new and unfamiliar) and if the risk is dreaded (a dread risk is an uncontrollable risk which can be catastrophic e.g. a plane crash). Dread and unknown risks are feared and are the factors which cause variance in the risk perception ratings across all national cultures. Literature has also established that voluntary risks (risks that are one's own choice e.g. driving a car) are more likely to be taken than involuntary risks. Voluntary risks are strongly linked to controllability, where the risk is under personal control. Applying this knowledge to the construction industry, this paper has concluded that since risks taken in the industry are usually under the individual's control, non-dread and known, construction risks are more likely to be tolerated and can be under-rated. As this is the case across all national cultures, this conclusion can be made for the global construction industry. In this study, thirty different unsafe acts were collected over a one-year period and findings suggested that a poor risk perception was almost always a perceived influence. The perception of risk can be altered by a variety of factors but common factors found to influence risk perception were benefit and work pressures. These two factors were usually linked as shortcuts were taken to benefit from saving time.

Keywords: Benefit, Construction, Ethnography, Risk Perception, Time Pressure.

## **INTRODUCTION**

Risk perception in the construction industry has been suggested to have a high influence on unsafe behaviours (Oswald et al., 2013). The aim of this study was to investigate the importance of risk perception in construction and the factors that influence risk perception. Through an ethnographic approach and application of the psychometric paradigm, unsafe acts that occurred on a large construction project (+£500m) in the UK were investigated.

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<sup>1</sup> D.Oswald@ed.ac.uk



## **CONTEXTUAL LITERATURE: RISK PERCEPTION**

Risk perception is a subjective assessment of the probability of an event happening and the severity of the consequences of such an event. Risk perception phenomenon became a growing concept in the 1960s when it was identified as a main factor in public opposition to new technologies and nuclear power. Early work into risk perception by Starr (1969) found that individuals would accept risks that are 1000 times greater if they are voluntary (e.g. driving a car) rather than involuntary (e.g. a nuclear disaster). Starr's quantitative margin was later challenged by researchers, but it is generally agreed that voluntary risks are more likely to be accepted than involuntary risks. Despite Starr's early findings there was little research on voluntary risk taking in the decade that followed (Lyng, 1990). The research that was conducted gave different interpretations of Starr's findings, which ultimately led to the psychometric paradigm, discussed in a later section. There has been an abundance of study on risk perception with three theoretical families being developed: anthropology/sociological approaches or 'culture theory', 'psychological approaches' and 'interdisciplinary approaches'. Psychological and cultural theories currently dominate the field of risk perception (Sjoberg et al., 2004).

### **Anthropological/Sociological Approach (Culture Theory)**

This approach suggests that perceptions are socially constructed by ways of life and cultural values. The Cultural Theory of risk (Douglas & Wildavsky, 1982) identifies four 'ways of life', with each corresponding to a certain social structure and outlook on risk. The four ways of life include: hierarchal, individualist, egalitarian and fatalist. The theory has not been widely accepted by researchers with Douglas (1992) even stating that the theory is controversial.

### **Interdisciplinary Approach: Social Amplification of Risk Framework**

The Social Amplification of Risk Framework (SARF) is a combination of research in the theories of sociology, psychology, anthropology and communications. The framework aims to explain how risk perceptions are amplified. The media are an important link in communication chains and have strong effects on the public's risk perception (Wahlberg & Sjoberg, 2000). They are also often seen as irresponsible, with interest in negative information and a special inclination towards low probability but high risk consequences i.e. dread risks. The news media across the nations vary their interest and tend to pay most of their attention to their own national problems (Mazur, 2006). There is also evidence to suggest that risk perceptions in nations change across time. In a study by Mazur (2006), perceptions were measured in 1993 and then again in 2000 in various nations. For nearly all hazards the Filipinos, Spanish, Israelis, Russians and Japanese had increased their ratings of danger considerably while the Germans, Bulgarians and Irish reduced their ratings. The study revealed that trends changed when news coverage changed e.g. when there was an increase in coverage of environmental danger in a nation, the perceptions of environmental danger increased; and when the coverage decreased, the perceptions decreased. This was the case for nine out of ten countries – only Ireland avoiding the trend.

## **Psychological Approach - The Psychometric Paradigm**

This approach concentrates on how people process information. In early works it was concluded that people sort and simplify information; but this shortcut can lead to biases in evaluation and comprehension (Kahneman & Tversky, 1974). This framework was built on more recently and became the so-called psychometric paradigm, which in the field of risk analysis, has been the most influential model created (Siegrist et al., 2005) and compared to culture theory it has been fairly successful in predicting and explaining perceived risk (Sjoberg et al, 2004).

The psychometric paradigm attempts to address why different people perceive hazards in different ways. Using this paradigm, the study of diverse groups revealed that psychometric scaling can identify and quantify differences and similarities in attitudes and risk perceptions amongst different groups (Slovic et al., 1985). To understand risk perception, the paradigm aims to reveal the factors which affect risk perception. An important paper (Fischhoff et al., 1978) compiled nine dimensions from literature, two of which: dread risks and unknown risks have been found to create the variance in risk rating perceptions.

### *Dread Risks*

Dread risks are low possibility but high consequence events such as the devastating terrorist attack on September the 11th 2001. It appears that people try to avoid dread risks - situations that are dreaded and are where many people can be killed at one time, as opposed to situations where the same number of people may be killed but over a longer period to time (Slovic, 1987). However, avoiding dread risks may cause deaths as a study by Gigerenzer (2004) estimates that 350 lives were lost on the roads in the 3 months following the attacks, as people avoided the dread risk of flying. In construction, Bohm (2010) found that perceived risk is linked to the perceived dread rather than the likelihood. Fatalities in the construction industry generally occur sporadically over a long period of time and hence dread risks are uncommon.

### *Unknown Risks*

The novelty of the risk is the other major factor found to create the variance in perceptions. Risks that are unknown have a higher risk factor associated with them due to their uncertainty, while risks that are familiar have a lower risk factor associated with them. Uncertainty is a psychological concept closely related to risk and is an important mediator of human response in unknown scenarios (Sjoberg, 2004).

### *Dread and Unknown risks in many National Cultures*

There have been studies investigating risk perceptions across different cultures and nationalities. The United States were the first country to publish findings on risk perception (reported by Fischhoff et al., 1978) and in 1983 the first comparative risk perception study was compiled when research was carried out in Hungary (Englander et al., 1986). This research aimed to use the same methodology to that of Fischhoff et al. (1978) in order to compare the findings in Hungary with that of the US. The results were very similar and had strong correlations with the two dominant factors (dread and unknown) in the US studies. The most striking difference between the two nationalities

was that the mean of the judgements of risk was almost double in American citizens than in their Hungarian counterparts. Soon after, another study in Norway was undertaken (Teigen et al., 1988). Norway's judgements of risk were lower than the US but higher than Hungary's. Their risk profile matched the Americans more closely than the Hungarians, in that, like the US citizens, they had greater concern for drugs and narcotics. There have also been studies in Asia as well as the United States and Europe. In 1989, Keown found that the mean risk ratings of Hong Kong students were not significantly higher than the US but differed greatly in the type of hazards. Yet despite this variance the two factors 'dread' and 'unknown' were again concluded dominant. This cross national study was also replicated in Poland (Goszczynska et al., 1991) with the same result: dread and unknown factor dimensions concluded dominant. The Polish risk judgement ratings were slightly higher than the Norwegians but lower than Hong Kong Chinese and the Americans and hence considerably higher than the Hungarians. In 1993 Karpowicz-Lazreg and Mullet replicated the study in France but also investigated education and gender impacts of risk perception. The mean risk judgement ratings were very similar to that of the Americans. Similar conclusions were also found in a later French study (Poumadere et al., 1995). Studies have found that Americans, Hong Kongese, Bulgarian, Japanese, Brazilian (Nyland, 1993), French and Polish subjects have high mean risks and Swedes (Nyland, 1993), Russians, Romanians and Hungarians have low ratings (Boholm, 1998). This evidence indicates that though the risk ratings vary throughout the globe as a mean and for different risk activities, the two dominant factors 'dread' and 'unknown' constantly have a significant influence.

### **Other Applicable Dimensions of the Psychometric Paradigm**

There are two other dimensions of the psychometric paradigm that are most applicable to the types of risks in this study: personal impact or benefit and controllability.

It has been found that the greater the benefit for an individual, the greater the tolerance of risk is amongst individuals (Slovic et al., 1982; Gregory & Mendelsohn 1993). This is apparent across many disciplines including construction. A simple example being: the mining industry is perceived a very high risk environment for workers yet reports (e.g. Moss, 2011) have suggested that workers appear unfazed by the risks, with the dangers being offset by the financial benefits. Controllability is linked to voluntary risk-taking (Sjoberg, 2001). Risks such as being a passenger on a plane could be deemed 'voluntary' but because the individual is not in control of the risk, the risk level associated is higher. In construction, most risks are taken by individuals that are in 'control'.

### **METHOD**

Research methods in the construction industry have been rather narrow, with Phelps and Horman (2010) arguing they are inadequate for exploring the complex interactions which lie at the roots of the industries widespread problems. Dainty (2008) has suggested that through qualitative and interpretative research, richer insights into the industry may be found. Ethnography – where the researcher observes and writes about a culture from the point of view of the subject – is an established qualitative research method that has become part of the research approaches used in the construction industry (see Pink et al.,

2013). This method can provide extensive and in-depth findings, but there are also limitations to this approach. Though it was not a restriction in this study, ethnography is time consuming. It is also strongly reliant upon establishing rapport with subjects, which can be challenging especially in industries such as construction - an industry that Loosemore (1998) describes as 'confrontational'. The main drawback is related to reliability, as the natural setting cannot usually be reproduced (Nurani, 2008). Criticisms such as unreliability and lack of validity of findings are often associated with ethnography and while some ethnographers ignore such criticisms, others address them but this often requires different techniques from those that were originally used (LeCompte and Gotz, 1982). The investigation used an ethnographic approach on a large civil engineering project in the UK (+£500m) utilising a 'moderate participation observer' stance. DeWalt and DeWalt (1998) suggest this can provide a good balance of involvement – for example, through observations and conversations with those involved – and necessary detachment to remain objective.

Thirty different unsafe acts were identified throughout a one year period and ranged in severity from potential first aid attention to a potential fatality. The acts selected were chosen as they were useful examples of the affect of risk perception on personal safety within the wider ethnographic study. To determine the importance and influence of risk perception, the unsafe acts were initially coded into factors which had influenced the behaviour. These factors were previously highlighted in literature and consisted of: poor management style, alcohol & drugs, poor risk perception, substandard design, inexperience, time pressure, national culture, lack of training, risk taking tolerance, tiredness, confidence and thrill seeking. Acts that were likely to be or could have been influenced by any of the factors were coded with that factor. This data was then coded and further explored using the computer software programme, Nvivo. It was deemed that all of the thirty acts were likely to be or could have been influenced by a poor risk perception.

The psychometric paradigm was then applied to the thirty examples taken from this study to attempt to investigate poor risk perception. The conclusions of this analysis were consistent: all were dread risks, known risks and almost all were undertaken by individuals under personal control of the risk. The vast majority also had personal benefit that usually involved saving time. To further demonstrate this finding the remainder of this paper provides first a discussion of ten of the unsafe acts recorded for this research followed by a quantitative application of the psychometric paradigm to these examples.

## **ANALYTICAL NARRATIVE**

Below are ten examples of the influences on risk perceptions found in this case study are discussed in detail.

### *Risk Compensation*

Risk compensation is a controversial theory (O'Neil, 1998) that suggests there is a certain level of risk at which people can accept that they are exposed to. Therefore, if a safety measure is introduced that reduces the risk; people can adjust their behavioural response i.e. take on more risk. This can lead to an unjustified lower level of perceived risk and

hence more risky behaviour (Sheehy and Chapman, 1987). For example, if seat belts are worn (the safety level increased), then the individuals can drive faster to reach their destination (behaviour change due to increased safety from seat belt). Therefore, according to this theory, the introduction of a safety measure is, in the long run, eliminated by human behavioural response (Peltzman, 1975). There were a couple of examples which to some extent supported the risk compensation theory. Following the issue of flame-resistant (but not fire-proof) overalls to hot works operatives, there were two incidents where operatives were set on fire (*example 1*). From a discussion with one of the operatives, he stated that he had never been set on fire in 25 years until he was given the fire protection. An investigation into the incident by safety advisors found that the operatives had taken a more comfortable but riskier stance during the work – a behaviour which increased the likelihood of this accident. This behaviour and the poor quality of the clothing resulted in the fire. Soon after, a similar incident occurred with another worker who was also just given fire resistant clothing. The other example occurred when a harnessed scaffolder was seen ‘monkeying around’ and using inappropriate access around the scaffold (*example 2*). When questioned, the scaffolder thought his behaviour was safe because he was harnessed on, but this is not good practice and is a clear example of safety measures affecting behaviours through risk compensation. In these circumstances the perception of risk had been altered by the introduction of a measure implemented with the intention of improving safety.

#### *Risk Taking, Confidence, Trust and Thrill-Seeking*

Risks may be taken if it is perceived risk is low, even if the benefit for taking such a risk is low. A common unsafe act that occurred on this construction project was breaking a well-known safety rule: workers are not permitted to use mobile phones in non-designated areas (*example 3*). The likelihood of an accident occurring due to lack of concentration (e.g. walking and talking on the phone and tripping) does increase when on a mobile phone but nevertheless it is still unlikely. Despite workers knowing that this behaviour is not acceptable and the benefit usually being low (e.g. you do not have to walk to a safe place and return the call) this risk is often taken. The more often the risk is taken, the more confident the risk-taker becomes - a factor which is known to have a negative impact on risk perception (Siegrist et al., 2005). Confidence can lead to complacency: for example one operative was observed hammering while not looking at what he was doing, instead having a conversation with his colleague (*example 4*). A more severe example occurred when the driver of a transportation boat (full of workmen) became confident and relaxed with the surrounding risks. A near miss occurred on a dark evening when the transportation boat narrowly avoided a tanker vessel (*example 5*). It is good practise for the transportation boat to be crossing the river at a 90 degree angle, but instead the boat took a quicker route and crossed at around a 45 degree angle (an example of benefit). The radar was on and working but the driver did not notice the tanker. The transportation boat carried on at a fair speed until it was radioed urgently by the tanker, and the transportation boat turned sharply left narrowly avoiding a collision. Though this could have been perceived as a dread risk, (many fatalities were possible) in post-incident witness statements, none of the passengers said they felt in danger which is also a sign of general trust influencing risk perception. The passengers trust the drivers, since they the



journey has been completed safely numerous times. High levels of trust have been found to reduce risk perceptions (Siegrist et al., 2005).

Individuals that become so relaxed and confident with surrounding risks can even partake in risk-taking for thrills. Through ethnography this can be difficult to conclude whether risks were taken for thrills; but one example of this did occur when an operative avoided a ladder instead using the tubing on a work elevated platform to climb up around 8ft (*example 6*). On inquiry he self-confessed that he was very bored with the work he had been doing and did it for excitement. Over-confidence can become dangerous and effect individual's risk perceptions, especially when they are being exposed to the same risks. Confidence usually comes with experience and can lead to relaxed safety behaviours, but inexperience can also effect risk perceptions. For example, an inexperienced banksman was standing next to the rear of a tipping wagon, while it unloaded (*example 7*). The banksman was at risk from falling material and could not be seen by the driver. It was only the banksman's second day on the job, and his lack of experience influenced his perception of the risks. A mixture of an experienced but cautious individual represents a good balance for risk perceptions.

#### *Voluntary Risks, Benefit & Work Pressures*

A factor present in many of the unsafe acts is voluntary risk taking. Individuals feel more comfortable with voluntary risk taking (Starr, 1969) since they are in control. A common unsafe act that occurred was the delivery drivers breaking the speed limits on-site (*example 8*). Since the drivers feel they are in complete control of this behaviour the risk is more likely to be accepted. Another influence on this behaviour is benefit. Drivers can be paid by delivery, which encourages risk-taking behaviour because of the greater benefit. Benefit systems are known to encourage risk-taking behaviour (Sawacha et al., 1999) but there were such systems used on this construction project 'unofficially' and unknown to senior management. Such unofficial benefit systems improve relationships between operatives and their supervisors but distort perceptions of risk. Good relationships with the operatives are very important for supervisors, as in a time of need they can rely on their workforce e.g. if extra work was required to be completed at the weekend. Work and time pressures can push middle-management to taking more safety risks. For example, there was an occasion where a beam delivery was due at the beginning of the following week. If the team were not ready for this delivery, they would need to wait a month for the next one. Therefore to stick to the tight schedule, around 20 operatives were working in an area that should have only had four or five workers in it (*example 9*). Such time pressures are a fairly common factor that can influence risk perception and risk taking. Even short time savers can cause an incident, for example, a crane cut a corner across a non-ground bearing surface (despite knowing to stay on the tarmac) and crushed the service cables running underground (*example 10*). These examples indicate a link between time pressures and benefit – work pressures cause risk-taking for benefit. The inverse relationship between perceived risk and perceived benefit has been found to be strengthened when time pressures are involved (Finucane et al., 2000).

## REFLECTIONS: APPLYING THE PSYCHOMETRIC PARADIGM

The psychometric paradigm uses numerous qualitative dimensions of risk. According to Jenkin (2006), the most commonly used include: immediacy, expert knowledge, controllability, novelty, delayed, certainly fatal, increasing, preventability, inequitable, affects future generations, global catastrophe, catastrophic potential, easily reduced and observability. Almost all unsafe acts in this study fell into the same categories for the above dimensions. For example, none of the unsafe acts could cause ‘global catastrophe’, they can all usually be ‘easily reduced’, consequential effects are almost always known immediately and are very unlikely to affect future generations. The other four dimensions (voluntary, known, dread, personal impact) that Jenkin’s highlights are most applicable to the unsafe acts that have been discussed. The psychometric paradigm has highlighted two clear factors when individuals are rating risks: dread and unknown risks. The unknown and dread dimensions are applicable because they have been found to cause the variance in risk perception ratings.

|                               | Known | Voluntary | Control | Catastrophic Potential | Dread | Personal Impact | Severity              |
|-------------------------------|-------|-----------|---------|------------------------|-------|-----------------|-----------------------|
| Operative on caught on fire   | Yes   | Yes       | Yes     | No                     | No    | Yes             | Major injury or Death |
| Scaffolder 'Monkeying around' | Yes   | Yes       | Yes     | No                     | No    | Yes             | Death                 |
| Mobile walk and talk          | Yes   | Yes       | Yes     | No                     | No    | Yes             | Major injury or Death |
| Hammering and not looking     | Yes   | Yes       | Yes     | No                     | No    | No              | Minor injury          |
| Potential boat crash          | Yes   | Yes       | No      | Yes                    | No    | Yes             | Multiple Deaths       |
| Climbing scaffold tube        | Yes   | Yes       | Yes     | No                     | No    | Yes             | Death                 |
| Banksman behind tipping wagon | Yes   | Yes       | Yes     | No                     | No    | No              | Death                 |
| Delivery drivers speeding     | Yes   | Yes       | Yes     | No                     | No    | Yes             | Death                 |
| Overcrowded beam delivery     | Yes   | Yes       | Yes     | No                     | No    | Yes             | Major injury or Death |
| Crane crushing services       | Yes   | Yes       | Yes     | No                     | No    | Yes             | Damage                |

*Table 1 - The ten discussed unsafe acts analysed by the most relevant dimensions in the psychometric paradigm*

This study suggests that in the construction industry it is rare that there are any dread risks. As dread risks are perceived as higher risk than non-dread risks, individuals can under-rate these non-dread risks. The other factor is unknown risks. Unknown risks are perceived as a higher risk than known. This study suggests that in the construction industry the vast majority of risks are known, usually because the risks re-occur again and again e.g. working at height. Such known risks can become under-rated, especially if an individual is constantly exposed to the same risks and becomes confident and relaxed around them. Unknown risks and dread risks are feared, and as the summary in Table 1 illustrates, all the risks were known and all were non-dread, meaning that they could be under-rated. The potential boat crash could have caused a multiple deaths, yet perhaps somewhat surprisingly from evidence gathered in the witness statements, this risk was not dreaded.

Individuals have been found to be more willing to accept ‘voluntary risks’. This is heavily linked to ‘controllability’, where less risk is associated with situations that are under personal control (Sjoberg, 2001). There was one example in this study where individuals were not in control - the passengers in the potential boat crash scenario. In the vast majority of situations individuals were in control, which is associated with less risk and hence scenarios could be under-rated. In many of the situations, there was personal

benefit distorting the perception of risk. The type of personal benefit was almost always to save time. The delivery driver speeding is perhaps the most obvious example, but there are many others such as: the crane diverting off the tarmac to cut a corner (but crushing the underground services), the overcrowded work area to finish work in time for the beam delivery, the scaffolder 'monkeying around' to move quickly around the scaffold and the supervisor walking and talking on his mobile phone rather than walking to a safe area and returning the call.

## **CONCLUSIONS**

Literature has found that risks that are voluntary and under personal control are more likely to be taken and that non-dread and unknown risks can be under-rated. From applying this knowledge to the construction industry it can be concluded that since the vast majority of the risks in this case study were voluntary, under personal control and non-dread and known risks in construction, they were more likely to be accepted and under-rated. This conclusion could be significant since a poor perception of risks has been suggested to being the most common factor in the unsafe acts investigated in this study. Other common influences on the perception of risk were found to be work pressures and benefit, and these are often strongly linked. Work pressures often cause risk-taking for timesaving benefits. Reducing these time pressures is difficult to achieve in practise, but the findings suggest that to improve safety in the industry potential improvements should be investigated.

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